

RECENT EARTHQUAKES.

Although earthquakes have but a very remote connection with meteorology, yet it seems to be expected that the observers of the Weather Bureau will record these, as also aerolites, and that some notice of these phenomena should appear in the MONTHLY WEATHER REVIEW. The Editor of the REVIEW hopes that some geologist will devote himself to the study of the slight tremors and occasional severe quakes that are so frequent throughout the United States, and that he may receive from such an one an authoritative monthly summary of seismic phenomena. For the present he can himself only undertake to give the briefest review of the character of the reports that accumulate monthly in the archives of the Weather Bureau.

There can be no doubt that the solid crust of our globe to a depth of 20 or 30 miles is in a state of strain, and that the strains are perpetually changing as to direction and intensity. Whenever any stratum of rock is too severely strained it must crack or crush suddenly. It may move up or down or sideways, and it may perform several oscillations to and fro before it comes to rest. A break once made in this way makes it easier for succeeding strains to make other breaks in the same locality. In this way mountain chains and great "faults" seem to have been formed. The small shocks that are so frequently experienced represent the minute steps in the process of elevation or depression by reason of which the general surface of the country is slowly rising above the ocean, or it may be occasionally sinking below it. The existence of sedimentary deposits along our coasts is held to be a visible record of the action of the ocean when that region was far below its present level. As large portions of the earth have undoubtedly risen and fallen alternately, though very slowly, through heights of several thousand feet, there have been produced corresponding changes in the climate, the flora and the fauna, and this may easily have gone to extreme limits so that regions that are now habited by man may have been in previous ages uninhabitable, and may in future ages return to that condition. From this point of view the elevations and the changes that are going on form an integral part of meteorology, since that science is often called upon to explain not merely the future weather under present conditions, but the so-called geological climate belonging to the land areas of ancient geological eras.

The principal recent earthquakes, as reported by voluntary observers and by the newspapers were: (The times have been corrected to the eastern or seventy-fifth meridian standard, so far as it was practicable for the Editor to do so, though doubt may remain in the case of a few towns where local rather than standard meridians still continue to be used.)

Sunday, April 25, Arkansas, Okeola.

The United States Consul at Pointe-a-Pitre, Guadeloupe, W. I. (Jacob E. Dart), communicates the details of a very serious earthquake at 10:20 a. m., April 29, at that place. The vibrations lasted five or six seconds, overthrew most of the houses and injured the heaviest walls; 42 persons were injured and 2 killed. It was but little felt on the western portion of Guadeloupe at Basse Terre, and it was most severe on the eastern slope of the mountainous land, especially at Pointe-a-Pitre and at Lamartin, two leagues northeast of that place. A strong quake was also felt at Martinique, about 100 miles to the southeast.

April 30, about 10 p. m., a shock lasting from two to twenty seconds in Tennessee, Illinois, and other points in the Mississippi Valley.

Sunday, May 3.

Virginia.—Blacksburg, 12:14, lasting four or five seconds. Salem, 12:30, eight seconds. Christiansburg, 12:15, thirty seconds. Radford, 12:16, eight seconds, very severe. Wythe-

ville, 12:24, thirty seconds, or 12:20, or 12:15, according to various observers. Roanoke, 12:20, thirty seconds. Finncastle, a few minutes before 1 p. m. Bedford City, 12:25, with a roaring noise. Farmville, no time, feeble shock. Pulaski, 12:20, destructive; chimneys injured. Lynchburg, 12:15, perceptible. Max Meadows and Bluefield, no time given. Harrisonburg, Rocky Mount, Lexington, and Woodstock, not felt.

District of Columbia.—Washington, no tremor noticed by any individual, but one was recorded by the Marvin seismograph at the Weather Bureau at 12:18:45 eastern standard time; the record shows only one shock of sufficient intensity to affect the instrument.

North Carolina.—Winston, 2:17 (which possibly should read 12:17), three or four seconds. Lenoir, 12 m. and 1:00 p. m.

Saturday, May 15.

Nevada.—Carson City, 11:04 a. m., lasting two seconds.

Thursday, May 27.

New York.—North Troy, 10:20 p. m., lasting thirty seconds, then ceased for a few seconds and continued again for fifteen seconds. Albany, 10:20 p. m. Whitehall, Port Henry, and Crown Point, no time. Elizabethtown, 10:15 p. m., lasting nearly two minutes, with a noise like heavy thunder. Glens Falls, 10:15, lasting ten seconds. Saratoga, lasting two minutes. Plattsburg, 10:15 p. m., lasting twenty seconds; worst shock ever experienced here. Fort Edward, no time. Lockport, 10:20 p. m., succession of slight shocks of about two minutes duration. Syracuse, 10:15 p. m., less violent than in northern New York. Antwerp, very heavy. Gouverneur, slight. De Kalb and Canton, severe. Potsdam and Norwood, much heavier. Adams Center, severe. Watertown, 10:15, slight. Remsen, southern limit of the area of the shock. Malone, ten seconds. Carthage, Pulaski, and Mexico, severe. Philadelphia, very severe. Rose, 10:15, one shock lasting several seconds. Whitehall, 10:20 p. m., forty-five seconds. Oswego, 10:30 p. m., Weather Bureau office, slight shocks lasting twenty seconds. Oswego (another report), 10:15, slight vibrations.

Vermont.—Bellows Falls, 10:13, two shocks. Burlington, 10:13 p. m., lasting fifteen seconds; four severe shocks; most severe of any in recent years. Cornwall, 10:15, slight. St. Johnsbury, 10:15. Strafford, 11:00. Vernon, 10:15. Woodstock, 10:15, lasting from five to twenty seconds.

District of Columbia.—Washington, the Marvin seismograph at the Weather Bureau recorded a series of shocks at 10:18 lasting forty-five seconds.

Canada.—Montreal, 10:15 p. m., perceptible rumbles for sixty-five seconds; severer shocks for ten seconds; another rumble at 10:46, but no shock; audiences at theatres greatly frightened. The notable previous shocks in Montreal were on November 27, 1893, March 22 and 26, 1897; the quake was felt throughout the Ottawa Valley and eastern Quebec; it was particularly severe at St. Hilaire Mountain. Ottawa, Ont., 10:15, lasting five seconds; unusually severe. Kingston, shock lasted several seconds.

New Hampshire.—Hanover, 10:15:09 p. m. to 10:15:19, eight or ten severe shocks; followed until 10:16:19 by many minor vibrations and a loud sound, probably due to the rattling of windows and the creaking of objects on the surface of the ground. Concord, 10:15, slight. Keene, 10:15, lasting thirty seconds.

Massachusetts.—Concord, 10:15, slight; lasting fifteen seconds. Fitchburg, 10:15, lasting twenty seconds.

Connecticut.—Hartford, no time given.

Monday, May 31.

South Carolina.—Spartanburg, 1:55 p. m., as severe as Au-

gust, 1886. Statesburg, Dr. W. W. Anderson, voluntary observer, reports the local time 1:36 p. m., whence the seventy-fifth meridian time is 1:57:30; the motion of the floor and its creaking were very distinct.

Georgia.—Atlanta, 1:00 p. m., alarming shake, most severe since 1884; the quake seems not to have extended into the Piedmont region. Savannah, 2:00 p. m. Covington, 1 p. m. Toccoa and Elberton, no time. Hepzibah, 1:05 central time, lasting two seconds.

North Carolina.—Lenoir, 1:58 p. m., loud roar; chimneys injured. Biltmore, 2:00 p. m., perceptible. Henderson, 1:57, severe, lasting ten seconds with a roaring sound. Hatteras, perceptible. Charlotte, 2:00 p. m., lasting fifteen seconds. Soapstone Mountain, rumbling noises. Linville and Waynesville, perceptible. Raleigh, two shocks, each lasting thirty seconds; chimneys thrown down. Greensboro, 2:00 p. m. Asheville, 1:59. Charlotte, 1:45. Throughout the mountain district violent shock. Murphy, lasted two minutes.

Tennessee.—Knoxville and Bristol, 1:15; continued thirty seconds. Chattanooga, 1:30 p. m.; slight shock. Tullahoma, 12:57. Greenville, 2:10. Harriman, 10:00 p. m.; oscillations for two minutes. Chattanooga, 1:00 p. m.; very slight, two shocks; the first at 1:00 p. m., lasting ten seconds, soon followed by a second of shorter duration.

Virginia.—Lynchburg, 1:58. Norfolk, 1:57. Danville, 1:58. Roanoke, it is said that in connection with the recent earthquake Angel Mountain is badly cracked, and nearly all the water drained out of Mountain Lake and the salt wells in Smythe County are completely dried up. Floyd, the severest shock ever felt here; brick and stone walls were cracked. Richmond, 1:59 p. m., violent vibrations and loud noises; two shocks at 1:59 and 2:11 p. m., respectively. Radford, 2:00 p. m. Wytheville, unusual seismic disturbances frequent during the past week in Giles County, causing fissures in the ground. Pearisburg, earthquake shocks nightly in Giles County since the 25th; large fissures have been made. Petersburg, 1:59; quite severe; the first since August, 31, 1889. Newport News, about 2:00 p. m.; brief but violent. Staunton, 1:58, heavy rumble.

West Virginia.—Charleston, 2:00 p. m. Huntington, 2:08 p. m.; the shock lasted ten seconds. Clarksburg, 2:02 p. m., lasting twelve seconds. Hinton, no details. Parkersburg, two shocks between 1 and 2 p. m. Newburg, severe shock. Grafton, windows broken and officials panic stricken.

Kentucky.—Covington, the waters in the lagoon dangerously rough. Louisville, shortly after 2:00 p. m., lasting five seconds. Greensboro, 2:00 p. m.; severe.

District of Columbia.—Washington, the Marvin seismograph at the Weather Bureau recorded a continuous series of shocks from 1:58:15 to 2:03:15, at least fifteen in all, sufficiently severe to make a record on the instrument, which is intentionally set so as not to be too sensitive for fear of its recording surface tremors produced by wagons.

Maryland.—Baltimore, Eastern Shore and southern Maryland; three distinct shocks.

Pennsylvania.—Williamsport, four or five wells have gone dry since the earthquake, which had never before failed. Pittsburg, 1:54 to 1:55 p. m., slight shock; perceptible in buildings, but not on the street.

Ohio.—Cleveland, 12:32 p. m., local time, the seismograph of Prof. Edward W. Morley, of Adelbert College, recorded the vibrations as being from northeast to southwest and about the hundredth part of an inch in extent. The times are not reported. Columbus, 1:02, lasting fifty seconds. Cincinnati, Weather Bureau station, 1:02 p. m., a wave of water started at the southwest extremity of the lake at Ludlow Lagoon, which by the time it reached the eastern shore of the lake was over 3 feet in height. The earthquake shock lasted one minute and a half. The shock was rarely noticed inside

of the city. Columbus, 1:02 p. m., for forty seconds, with two distinct shocks. Zanesville, about 1 p. m., alarming vibrations. Cleveland, 12:43, severe shock.

Indiana.—Indianapolis, 1 p. m. Anderson and Vevay, no time.

Sunday, June 20.

California.—Gilroy, 12:11 p. m. Oakland, 12:13 p. m., lasting seven seconds, followed by a milder tremor. At the Chabot Observatory, according to Professor Burchalter, the seismograph showed distinct tremors lasting in all eight seconds, the first one being at 12:13:25 (or thirty-five seconds) p. m. San Francisco, 12:13 p. m., and slight shock at 12:59, and a still slighter one at 6:37 p. m. At the observatory of the Coast and Geodetic Survey a slight shock was observed at 6:37 a. m., and a severe one at 12:15 p. m., after which there were two distinct tremblings and final shock at 12:48 p. m. All these were recorded personally, as the official seismograph was out of order. Sacramento, 12:12, very light. Decoto, 12:13, two heavy shocks; at 12:50 a severe one. Haywards, 12:01, two shocks. Santa Rosa, one shock. Milton, 12:15. Visalia, 12:10, two shocks. Merceda, 12:13, two shocks three or four seconds apart. Modesto, sharp shock. Stockton, at 12:14 p. m. Los Gatos, 12:14 p. m., lasting ten seconds. San Jose, severe and long. Mount Hamilton, Lick Observatory, 12:12:56 p. m., shock from east to west followed by complex movements for twenty seconds. Pacific Grove, 12:15 p. m., continuing for several minutes. Monterey, heavy shock; the adobe wall of the San Carlos Mission thrown down. Del Monte, three shocks, preceded by a rumbling. Templeton, 12:15 p. m., lasting twelve seconds. Santa Cruz, 12:13, a severe shock, and an hour later a lighter one. Salinas, 12:15, the severest shock on record, lasting thirty seconds. Courthouse, brick buildings, and chimneys injured. Gilroy, 12:11 p. m., heaviest shock ever felt here, except that of 1868; lasted only a few seconds; chimneys and brick walls badly injured. Hollister, 12:15, severest shock since 1868, lasting fifteen seconds, from north to south; all brick buildings injured, and several badly damaged. San Rafael, slight shocks at 12:14 and 12:56. Gonzales, very heavy. Fresno, earthquake lasting from three to ten seconds. Sacramento, very slight. Redwood City, severe. Watsonville, heaviest since 1881. In general the reports seem to show that the shock was heaviest and most damaging in the neighborhood of Hollister, San Juan, and Salinas, and it would be important to ascertain whether the coast line on either bank of the San Benito River shows any change of altitude in that region, or in the Bay of Monterey and the Peninsula of Santa Cruz.

Mexico.—At Oaxaca two shocks were felt on the 20th and one at 3 a. m. of the 21st in continuation of the disastrous earthquake that destroyed Tehuantepec a few days before. There is no apparent connection between these earthquakes in the Andes, Cordilleras, and Rocky Mountains and the formation of new volcanoes, notwithstanding the numerous popular reports to the contrary, but there is much reason to think that these closely associated shocks in Central America, Mexico, and California were part of the same shifting of geological strata.

Washington, D. C., June 28.—The seismograph at the Weather Bureau in Washington showed record of a slight shock of earthquake at 11:28 p. m., standard time, June 28. This must have been a single slight shock barely sufficient to make one record. Earthquakes of greater intensity are characterized by a succession of several shocks sufficient to make a record on the Marvin seismograph, between which may occur numerous gentler oscillations or milder shocks or slow tipplings of the earth to and fro, such as this apparatus is not designed to record.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Mariano Bárcena, Director, and Señor José Zendejas, vice-director, of the Central Meteorologico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the *Boletín Mensual*; an abstract translated into English measures is here given in continuation of the similar tables published in the MONTHLY WEATHER REVIEW during 1896. The altitudes occasionally differ from those heretofore published, but no reason has been assigned for these changes. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart III.

Mexican data for June, 1897.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
Barranque (Coahuila).	5,413	28.84	85.9	66.4	75.7	2.36	.....	.....	.....
Carneros (Coahuila).	.....	.....	85.3	59.0	68.5	3.74	.....	.....	.....
Cullacan	112	29.87	98.6	72.5	86.4	0.37	w.	e.	.....
Guanajuato	6,761	28.67	91.3	55.0	69.4	6.39	ene.	ne.	.....
Leon	5,934	28.34	91.2	56.3	72.9	5.58	ene, ese.	ene.	.....
Linares	1,188	.....	99.0	68.2	83.3	1.28	ese.	.....	.....
Magdalena (Sonora).	4,948	.....	97.9	72.0	82.8	.....	sw.	n.	.....
Merida	50	29.89	101.1	71.2	82.4	3.63	e.	e.	.....
Mexico (Obs. Cent.)	7,472	28.07	84.2	50.4	64.6	5.47	nw.	ne.	.....
Mexico (E. N. de S.)	.....	28.09	84.2	47.3	62.4	5.67	sw.	.....	.....
Monclova	.....	.....	104.4	64.8	86.5	1.77	.....	.....	.....
Morelia (Seminario)	6,401	28.96	78.3	53.2	64.4	4.79	ese.	ne.	.....
Oaxaca	5,164	28.06	90.7	55.3	73.0	9.93	nw.	ne.	.....
Parras (Coahuila)	3,986	.....	97.7	66.6	80.1	4.92	.....	.....	.....
Puebla (Col. Cat.)	7,112	28.37	81.7	53.6	66.6	71.4	e.	nw.	.....
Queretaro	6,070	24.17	86.4	55.6	70.0	5.09	e. ene.	.....	.....
Saltillo	5,399	24.76	90.7	59.9	74.1	1.61	s.	.....	.....
San Luis Potosi	6,302	24.13	85.1	56.7	69.4	4.66	e.	e.	.....
Sierra Mojada (Coah)	.....	.....	96.3	59.0	79.0	2.17	.....	.....	.....
Silao	6,063	24.24	85.1	64.0	73.6	4.12	ene.	w.	.....
Toluca	8,612	21.91	77.9	46.4	61.5	3.58	ese.	ne.	.....
Torrón (Coahuila)	3,730	.....	107.6	68.4	88.7	4.53	.....	.....	.....
Trejo (H. d. S. Gto.)	6,011	.....	.....	.....	.....	3.60	ne.	.....	.....
Tuxtla Gutierrez	1,864	28.06	98.6	66.2	78.6	10.83	nw. nnw.	.....	.....
Zacatecas	8,015	22.53	84.0	47.1	65.7	7.06	e.	e.	.....
Zapotlan (Seminario)	5,078	25.06	90.0	58.6	73.8	8.81	se.	se.	.....

Mexican data for April, 1897.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
Aguascalientes	5,119	28.84	85.6	41.7	64.4	21.00	w.	se.	.....
Barouso (Coahuila)	5,413	.....	84.2	47.3	73.4	0.39	.....	.....	.....
Carneros (Coahuila)	.....	.....	88.7	47.1	61.9	0.98	.....	.....	.....
Collima (Seminario)	1,656	28.27	96.8	55.0	75.4	5.00	sw.	w.	.....
Collima	.....	.....	.....	.....	78.8	.....	.....	.....	.....
Cullacan	112	29.71	95.0	58.1	78.3	47.00	w.	e.	.....
Guadalajara (O. d. E.)	5,186	24.97	92.1	50.2	72.3	94.00	sw., nw.	sw.	.....
Guanajuato	6,761	28.67	89.1	51.3	70.2	31.03	ws.	sw.	.....
Jame (Coahuila)	.....	.....	80.1	29.7	56.3	T.	.....	.....	.....
Lagos	6,275	24.12	84.4	51.1	68.7	34.00	nw.	nw.	.....
Leon	5,934	24.28	89.6	49.3	71.4	27.02	ws.	.....	.....
Magdalena (Sonora)	4,948	.....	90.0	50.0	72.1	0.00	n.	n.	.....
Mazatlan	25	29.92	81.9	63.7	73.8	78.00	nw.	sw.	.....
Merida	50	29.92	102.2	63.7	81.5	68.52	se.	w.	.....
Mexico (Obs. Cent.)	7,472	28.00	85.6	45.5	65.5	42.12	nw.	sw.	.....
Mexico (E. N. de S.)	.....	28.08	82.3	46.0	62.6	40.12	nw.	.....	.....
Monterey	1,626	28.13	96.8	45.5	74.1	57.08	ne.	ne.	.....
Morelia (Seminario)	6,401	28.97	86.7	52.0	68.9	41.00	sw.	e.	.....
Oaxaca	5,164	25.05	94.8	46.8	74.5	1.21	ese.	sw.	.....
Pachuca	7,368	22.56	82.5	39.9	62.1	47.06	nne.	.....	.....
Parras (Coahuila)	3,986	.....	92.3	50.5	70.0	0.79	.....	.....	.....
Pareta, La. (Coahuila)	.....	.....	99.7	52.3	75.6	T.	.....	.....	.....
Puebla (Col. Cat.)	7,112	28.36	86.0	45.3	69.4	45.01	e.	sw.	.....
Saltillo (Col. S. Juan)	5,399	24.78	91.6	44.2	66.4	51.03	n.	sw.	.....
Silao	6,063	.....	.....	.....	.....	.....	.....	.....	.....
Sierra Mojada (Coah)	.....	.....	88.5	53.8	67.5	.....	.....	.....	.....
Tacubaya (Obs. Nac.)	7,630	.....	.....	.....	.....	.....	.....	.....	.....
Tampico (Hos. Mil.)	88	.....	.....	.....	.....	.....	.....	.....	.....
Tehuacan	5,458	.....	.....	.....	.....	.....	.....	.....	.....
Toluca	8,612	21.91	80.8	41.2	61.2	42.02	w., se.	.....	.....
Zacatecas	8,015	22.53	82.4	41.0	64.6	39.00	sw.	w.	.....
Zapotlan (Seminario)	5,078	25.06	90.0	50.0	74.5	36.00	se.	sw.	.....

SEISMOGRAPHS AT METEOROLOGICAL STATIONS.

In order to disabuse the public mind as to the connection between the weather and earthquakes and in order to show

that the study and prediction of earthquakes may become practicable under the guidance of expert geologists, it is desirable that, at least temporarily, there be established self-registering seismographs and seismoscopes under the care of reliable physicists and painstaking meteorological observers. The physicists may establish and care for the complex seismographs, but the meteorological observers can easily look after the seismoscopes as they are comparatively simple.

As Professor Marvin's form of self-registering apparatus is simple and has stood the test of actual use for several years, there can be no doubt but that it is eminently adapted to its purpose and worthy of wide dissemination. The seismoscope, the clock, the recording cylinder, and the installation would probably cost about \$150.

CLIMATE AND CRIME.

The public press has lately given much attention to the subject of the relation between weather and crime. This seems to have started with a private communication from some Weather Bureau observer and has greatly interested every one. A preliminary collection of statistics seems to indicate that crime is more prevalent in hot weather.

The Chief of the Weather Bureau has expressed his opinion that it is utterly wild to contemplate at present the possibility of issuing predictions of prevalence of crime, and he has no intention of attempting it. In fact, there is no official investigation of the subject being made or contemplated in the Weather Bureau and no legal authority for doing so, even if it were considered desirable, which it is not. The statistics of disease have generally shown a very broad connection between climate and disease and the investigation of that subject is ordered by Congress, but that has no official connection with crime. The discussion of such difficult subjects is a matter of the careful study of statistics by physicians, and any conclusions that may at first seem to be justified need to be checked by later investigations before they can be practically applied to the public welfare.

CLIMATOLOGICAL DATA FOR JAMAICA, W. I.

Through the kindness of Mr. Maxwell Hall, of Montego Bay, Jamaica, the meteorological service of that colony has acceded to the request of the Editor for the prompt communication of an abstract of the very interesting climatological records of that highly important West Indian station. The climatological summary for June, 1897, furnished by Mr. Hall through his assistant, J. F. Brennan, of the Meteorological Office, is reproduced in the following table. The stations therein mentioned have the following locations:

Stations.	Altitude.	Latitude.	Longitude.
Moran Point Lighthouse	Feet, 8	17 56	76 10
Negril Point Lighthouse	38	18 16	76 22
Kingston	50	17 58	76 48
Kings House	400	.....	.....
Castleton Gardens	580	18 12	76 50
Hope Gardens	600	.....	.....
Stony Hill Reformatory	1,400	.....	.....
Hill Gardens (Cinchona Plantation)	4,907	18 5	76 39

The stations King's House, Hope Gardens, and Stony Hill Reformatory, are near Kingston, and are not supplied with mercurial barometers. The barometric pressures as given for these Jamaica stations are reduced to the standard instrumental temperature (32° F.) and standard gravity (latitude 45° and sea level), and all except Hill Gardens are also reduced to sea level. The thermometers are exposed in Stevenson Screens, and their readings have been corrected for